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AUTHOR	Edwards, Bernell; Gerlach, Vernon
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ABSTRACT

A study was made to determine whether instructional cues presented to the learner as variations of audiovisual and textual information including a cue summation condition (combined textual, pictorial, and auditory cues) can facilitate the achievement of precise instructional objectives. Some 112 education students enrolled in a course on mental retardation at Arizona State University were randomly assigned to one of eight treatment variations. Cues were imbedded within a self-instructional unit on cerebral palsy. Subjects were given a posttest immediately after instruction. Students receiving textual-only cues scored significantly higher (p less than .01) on the posttest than did students receiving auditory cues only. Students receiving the cue summation condition of cues did not score significantly higher than did students receiving other combinations of cues. (Author/WCM)

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THE EFFECTS OF SUMMATION OF AUDIOVISUAL AND TEXTUAL INSTRUCTIONAL CUES ON STUDENT ACHIEVEMENT

DR BERNELL EDWARDS*
Human Resources Laboratory
Williams Air Force Base, Arizona

DR VERNON GERLACH*
College of Education
University of Minnesota
Minneapolis, Minnesota

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*The research was performed while the authors were at Arizona State University, Tempe, Arizona

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The Effects of Summation of Audiovisual and Textual Instructional Cues on Student Achievement

Purpose

The essential premises of the cue summation theory have been developed in the work of Miller, Hartman, and Severin. Miller stated that when multiple cues elicit the same response simultaneously or in proper succession, they should summate to yield increased effectiveness. Hartman described the cue summation theory as follows: "Stated a number of different says, this predicts, essentially, that the learning of discriminations is increased as the number of available cues or stimuli is increased."

The focus of this research study was the instructional cue within the stimulus condition of cue summation. The purpose was to ascertain whether the previous research relating to the summation of cues in audiovisual contexts is generalizable to the application of instructional cues within real-time instructional environments. The objective of the study was to determine whether instructional cues presented to the learner in a cue summation condition and within the context of self-instructional materials can facilitate achievement of precise instructional objectives.

Rationale

Stimulus materials incorporating various levels of cues relevant to specific objectives were developed and tested comparatively in both the auditory and visual channels under

varying levels of the cue summation condition. In this study instructional cues were developed as integral components of an instructional unit following an instructional product development model. Instructional cues were embedded in three stimulus modes (textual, pictorial, and auditory). The specific content of each cue differed slightly according to its materials format. However, all three cue modalities were designed so that their content is relevant to the same instructional objective. The instructional unit employed in this study included several instructional objectives. Thus, the instructional cues were not merely redundant across modalities, but represented sufficient variation in both content and sensory channels to provide a meaningful test of the cue summation principle as applied to instructional cues.

A departure from the methodology of previous studies was made in the present study in the method of presenting cues to the learner. In previous studies cues were usually presented simultaneously in various modalities through audiovisual devices. For example, a visual cue might have been presented to learners through motion picture film while simultaneous auditory cues were presented through the sound track of the film. In the present experiment the instructional cues relevant to a single objective were not always presented to the learner simultaneously. Since the instructional cues are embedded in self-instructional materials, the precise timing of the presentation of related cues to the learner was controlled to an extent by the learner himself as he attended to the sequence of instruction. This provision applies primarily to the presentation

of the auditory cues, which were presented externally (the audio recordings) to the textual and pictorial cues. The presentation of textual and pictorial cues was controlled to a relatively high degree by their arrangement within a booklet of instruction.

The hypotheses tested in this study were:

(1) There will be no significant difference between achievement of subjects who receive multiple instructional cues in a summation condition (textual, pictorial, and auditory modalities) and of subjects who receive instructional cues in conditions of two of less modalities when achievement is defined as raw scores for subjects on posttests administered immediately following instruction.

(2) There will be no significant difference between achievement of subjects who receive instructional cues in two sensory channels (visual and auditory) and of subjects who receive instructional cues presented in a single sensory channel (visual or auditory) when achievement is defined as the raw scores of subjects on posttests administered immediately following instruction.

(3) There will be no significant difference between achievement subjects who receive instructional cues in a textual condition and those who receive instructional cues in an auditory condition when achievement is defined as raw scores for subjects on posttests administered immediately following instruction.

Procedures

One hundred twelve education students in their junior and senior years at Arizona State University enrolled in a course in mental retardation participated in an investigation of the effects of variations of instructional cues in the sensory modalities of textual, pictorial, and auditory information (within a self-instructional unit on cerebral palsy) upon the achievement of subjects. Ss were randomly assigned to one of eight treatment variations of cues as follows: (1) a textual pictorial-auditory cue combination

(a cue summation condition in which all three modalities of the instructional cues were presented to learners), (2) a textual-pictorial cue combination, (3) a textual-auditory cue combination, (4) a pictorial-auditory cue combination, (5) textual cues only, (6) pictorial cues only, (7) auditory cues only, and (8) no cues, only basic textual materials of the instructional unit. A randomized posttest only control group design was employed. Comparisons of the effects of variations in the cue conditions upon posttest achievement were made by a one-way analysis of variance.

Results

Ss receiving textual-only cues scored significantly higher ($p < .01$) on the posttest than did those receiving auditory cues only. Ss receiving the cue summation condition of cues did not score significantly higher on the posttest than did those receiving cues in one sensory channel (visual or auditory). The results of the analysis of variance between treatment groups was not significant at the .05 level of confidence. The probability of the obtained F-ratio was .08.

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INSERT TABLE I ABOUT HERE (Overhead Transparency)
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However, an inspection of the data in Table I reveals a trend of ascending posttest mean score according to treatment groups which is generally consistent with the hypothesized superiority of the cue summation condition.

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It is suggested that repeated studies of cue summation effects be conducted under less severe time constraints for learners. For example, instructional materials should be designed for a two-hour instructional period rather than for a one-hour period. This would facilitate a more comprehensive treatment of subject matter, a longer reading/study time period for learners, and a posttest containing 50 items.

Replicated studies of cue summation as an instructional variable should be conducted over a diversity of subject matter involving experimentation with other instructional variables such as task difficulty. Cue summation should also be investigated in conjunction with a variety of instructional tasks, which involve criterion skills in which the universe of appropriate practice and mastery items is relatively large.

It is also suggested that future investigations of multiple cues incorporate experimental designs which provide for measures of learning retention. It is possible that instructional cues in various modalities or combinations of modalities may facilitate various levels of learning retention.

Table I

Posttest Means Score and Standard Deviations by Treatment Groups According to Cue Modalities

Group	N	Mean	S.D.
1 (TPA)	14	20.00	2.93
2 (TP)	15	18.07	6.61
3 (TA)	13	19.00	5.14
4 (PA)	14	17.70	6.05
5 (T)	14	17.70	3.82
6 (P)	13	19.15	5.09
7 (A)	14	14.00	5.53
8 (C)	15	15.00	5.59

TABLE II

Posttest Mean Scores, Standard Deviations, and Percentage of Items Correct on Posttest According to the Number of Instructional Cues

GROUP	N	MEAN	S.D.	POSTTEST SCORE %
Three Cues (Summation)	14	20.00	3.03	72
Two Cues	42	18.23	6.09	65
One Cue	40	16.92	5.46	60
No Cues	15	15.00	5.59	54